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ABSTRACT

An instructor's manual and student activity guide on the ignition system of small engines are provided in this set of prevocational education materials which focuses on the vocational area of trade and industry. (This set of materials is one of ninety-two prevocational education sets arranged around a cluster of seven vocational offerings: agriculture, home economics, distributive education, health occupations, world of work, trade and industry, and office occupations.) The instructor's guide is organized into the following elements: title of activity, duration of activity (five to ten days), activity goals, instructional objectives (five), related vocational clusters, and activity implementation (description, materials needed, safety considerations, teacher preparation prior to class, during the class, follow-up activities, answer keys to student check point activities, and masters for duplication [e.g., check sheets--identification of tools and parts of the ignition system]). The student activity guide (for working on the ignition system of a small engine) provides step-by-step instructions (narrative and illustrations) for completing each instructional objective. At the end of each set of instructions is a student check point (evaluation activity). Occupational descriptions for an automobile mechanic, automobile mechanic helper, and automobile service station attendant conclude the document. (JH)

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ED169296

T & I – SMALL ENGINE REPAIR, THE IGNITION SYSTEM

Kit No. 7

INSTRUCTOR'S MANUAL

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1978

CE 020 481

U.S. DEPARTMENT OF HEALTH
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TITLE OF ACTIVITY

Kit No. 7, T & I – Small Engine Repair, The Ignition System

DURATION

Main Activity – 4 to 7 days
Follow-up Activity – 1 to 3 days

GOALS

The student will learn to repair small engines.

The student will be able to make some decision about being a mechanic.

The student will have an understanding of how the ignition system works on a small engine.

INSTRUCTIONAL OBJECTIVES

The student will be able to identify all the tools needed to take down, rebuild, and tune the ignition system.

The student will be able to identify all the parts of the ignition system.

The student will clean a spark plug.

The student will disassemble the ignition system parts.

The student will operate (start) the engine to check his/her work.

VOCATIONAL CLUSTERS

Office Occupations

ACTIVITY IMPLEMENTATION

A. Description

This activity describes how to take down and rebuild the ignition system of a small gas engine in simple step-by-step instructions.

The students are provided with hands on work activities associated with small engine repair. The time needed to complete the project is two to four 55 minute class periods.

B. Safety

Tools and equipment should be handled carefully to avoid injury by dropping tools and equipment on hands and feet.

C. Materials

1. Audio-Visual Equipment
   None needed
2. Technical Equipment
   1 – ¼ x 6 screwdriver
   1 – brass hammer
   1 – flywheel holder
   1 – contact assembly breaker
   1 – condensor
   1 – feeler gauge
   1 – 3/8 in. (.9525 cm) square drive ratchet
   1 – torque wrench, 0 to 600 in/lb
   1 – 7/16 in. (1.111 cm) knockoff tool
   1 – 3 hp Tecumsen engine
   1 – 7/16 in. (1.111 cm) socket (3/8 in. drive)
   1 – ½ in. (1.27 cm) socket (3/8 in. drive)
   1 – 11/16 in. (1.746 cm) socket (3/8 in. drive)
   1 – 13/16 in. (2.064 cm) socket (3/8 in. drive)
   1 – 9½ in. (24.13 cm) long arc joint pliers
   1 – set of King Feature 30 Career Series
3. Expendable Materials
   Gas
   Oil
   Rags
   1 piece emery cloth (fine)

D. Preparation Prior to Class

Read through the instruction book.

Work through the steps before assigning them to the students.

One to four students can work in a group.

Time to complete the assignment is two to four 55 minute class periods.

Duplicate the check sheets (using equipment available in office) before making assignments to students.

When assigning the students to an engine have them fill out the check sheet.

Although the students can work in groups, it is also possible to assign them to work on the engine individually to see what they have learned.

E. During Class Session

INTRODUCTION – This activity is designed to help you learn how to work on the ignition system. It is very important that you follow the instruction given in this handbook very carefully. When you complete the activity, you will be able to decide if you want to be a mechanic. If you do not want to be a mechanic, you will have the knowledge to work on your own small engine.

TO THE TEACHER –

1. Give out handbook.
2. Give out check sheets to students as they are ready for them.
3. Move about the room so that you'll be able to check off checkpoints as needed.
4. While students can work in groups you may find that all students cannot be fully involved with working on the motors due to the number of motors and tools available. Here are a few suggested activities to be carried on while students work through the hands-on manipulation of the motor.
   A. Using the King Feature Series, let students select readings and have them answer the questions at the end of the booklet on a separate sheet of paper.
   B. Have students identify items run by small gas engines. May use library or other references.
   C. Investigate people involved with power mechanics: Roger Benz, Nicholas Cugnot, Charles Duryea, Henry Ford, Ranson Olds.
   D. Explain the difference between a 2- and 4-cycle gas engine.

F. Follow-up Activities

1. Fill out a VIEW Fact Sheet.
2. Have students interview a mechanic on related fields (service station owner).
3. Report to class on interview.

ANSWER KEY

Identification of Tools

1.	K	A.	3/8 inch Drive Ratchet
2.	B	B.	Screwdriver
3.	J	C.	11/16 Socket
4.	L	D.	Channel-O-Pliers
5.	H	E.	½ in. Socket
6.	F	F.	Torque Wrench
7.	D	G.	13/16 Socket
8.	G	H.	Knock-off Tool
9.	C	I.	7/16 Socket
10.	E	J.	Flywheel Holder
11.	I	K.	Brass Hammer
12.	A	L.	Feeler Gauge

Parts of Ignition System

1.	H	A.	Stator Assembly
2.	A	B.	Movable Points
3.	L	C.	Coil
4.	D	D.	Flywheel
5.	I	E.	Points Cover
6.	B	F.	Coil Clip
7.	P	G.	Points Cover Gasket
8.	O	H.	Shroud and Recoil Starter
9.	C	I.	Stationary Points
10.	M	J.	Shroud Bolt
11.	J	K.	Points Cover Clip
12.	F	L.	Screen and Recoil Starter Clutch
13.	G	M.	Flywheel Key
14.	E	N.	Crankshaft Nut
15.	K	O.	Head Bolt
16.	N	P.	Condensor

MASTERS FOR DUPLICATION

1. VIEW Fact Sheet
2. Check sheets
   - Identification of Tools
   - Identification of Parts of Ignition System
   - Working on the Ignition System

VIEW FACT SHEET

NAME _____ CLASS _____ OCCUPATION _____

A. List the advantages (good points) of this occupation (job).

B. List the disadvantages (bad points) of this occupation (job).

C. List three things you should know to do this occupation (job).
   1.
   2.
   3.

D. What type of education should you get to be prepared (do) for this occupation (job)?

E. What courses must you take to go into this occupation (job)?

F. What do you think your future in this occupation (job) will be?

G. What wage can you expect in this occupation (job)?

H. What are the working hours of this occupation (job)?

I. To learn more about this occupation (job), write to:

J. Using a scale of 1 to 5, circle the number that measures your interest in this occupation (job) as a possible career.

I don't like it. 1 2 3 4 5 I like it.

CHECK SHEET FOR IDENTIFICATION OF TOOLS

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

A. 1/8 Inch Drive Ratchet
B. Screwdriver
C. 11/16 Socket
D. Channel-O-Pliers
E. ½ in. Socket
F. Torque Wrench
G. 13/16 in. Socket
H. Knock-off Tool
I. 7/16 in. Socket
J. Flywheel Holder
K. Brass Hammer
L. Feeler Gauge

CHECK SHEET FOR IDENTIFICATION OF PARTS OF IGNITION SYSTEM

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____

A. Stator Assembly
B. Moveable Points
C. Coil
D. Flywheel
E. Points Cover
F. Coil Clip
G. Points Cover Gasket
H. Shroud and Recoil Starter
I. Stationary Points
J. Shroud Bolt
K. Points Cover Clip
L. Screen and Recoil Starter Clutch
M. Flywheel Key
N. Crankshaft Nut
O. Head Bolt
P. Condensor

CHECK SHEET FOR WORKING ON THE IGNITION SYSTEM

NAME: _____

DATE: _____

TIME STARTED: _____

TIME COMPLETED: _____

TOTAL TIME: _____ + _____ = _____

REQUIREMENTS:	COMPLETED:
I. IGNITION SYSTEM TAKEN DOWN	
II. REBUILDING IGNITION SYSTEM	
Check 1 – Clean spark plug	
Check 2 – Condensor	
Check 3 – Points	
Check 4 – Stator assembly on engine	
Check 5 – Set point at .020	
Check 6 – Points cover gasket	
Check 7 – Points cover	
Check 8 – Points cover clip	
Check 9 – Flywheel key	
Check 10 – Screen and recoil starter clutch	
Check 11 – Crankshaft washer and crankshaft nut	
Check 12 – Shroud and recoil starter	
Check 13 – Torque headbolts	

T & I – SMALL ENGINE REPAIR, THE IGNITION SYSTEM

Kit No. 7

STUDENT
LEARNING ACTIVITY GUIDE

Prepared by

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SMALL ENGINE REPAIR

INTRODUCTION

This handbook will provide you with the information needed to work on the ignition system of a small engine. When you have completed this booklet, you should be able to make some choice about a career as a mechanic.

GOALS

The student will be able to identify all the tools needed to take down, rebuild, and tune the ignition system.

The student will be able to identify all the parts of the ignition system.

The student will disassemble the ignition system.

The student will replace the ignition parts.

The student will operate the engine to check the work.

DIRECTIONS

Follow the step-by-step instructions very carefully.

At any time you do not understand anything, review the previous steps.

After reviewing the steps and you still have a question, ask your instructor.

Complete each step before going to the next step.

As you take down the ignition system, study each part before removing it.

To assure good work, it is important that you take your time.

Read through the entire booklet before doing any steps.

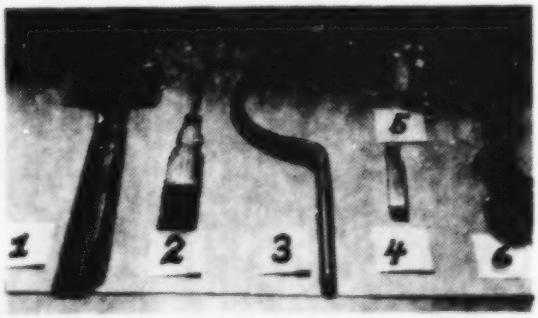
MATERIALS

The student will need to obtain the tools and engine from the teacher before starting to work.

PROGRAMMED TEXT

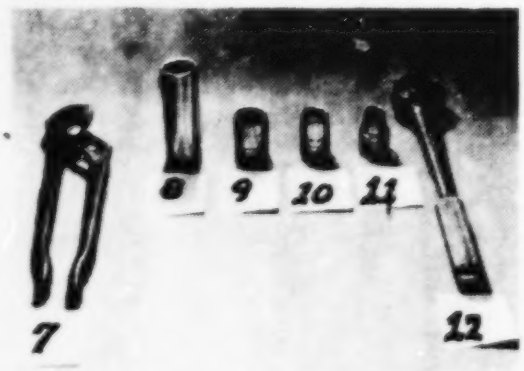
Instructional Objective 1

Learn to identify the following tools needed for work on the ignition system.



STEP 1 – Locate the tools with proper names.

1. Brass Hammer
2. Flat Blade Screwdriver
3. Flywheel Holder
4. Feeler Gauge
5. Knock-off Tool
6. Torque Wrench



STEP 2 – Locate the tools with proper names.

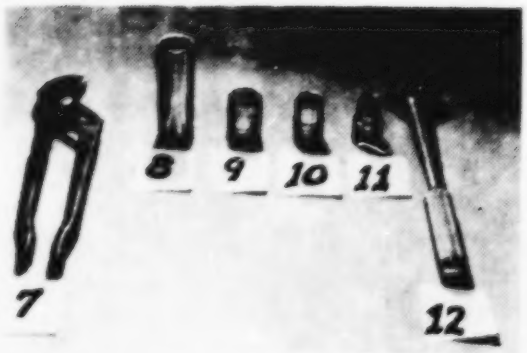
7. Channel-O-Pliers
8. 13/16 Socket or Spark Plug Socket
9. 11/16 Socket
10. ½ Socket
11. 7/16 Socket
12. 3/8 Inch Drive Ratchet

Check Point

After you have studied STEPS 1 and 2, get a check sheet from your teacher.

Look at the following two pictures. Match the number on the picture to the answer you think is correct.

When you have matched all the blanks, check with your teacher to see if you answered correctly.



If you have matched them correctly, you may proceed to Objective II.

If you missed any, go back and study STEPS 1 and 2.

Get another check sheet and repeat CHECKPOINT.

Instructional Objective II

Learn to identify the following parts of the ignition system.

STEP 1 – Locate the parts with the proper name.

1. Shroud and Recoil Starter
2. Stator Assembly
3. Screen and Recoil Starter Clutch
4. Flywheel

STEP 2 – Locate these parts with proper name.

5. Stationary Points
6. Movable Points
7. Condensor
8. Head Bolt

STEP 4 – Locate these parts with the proper names.

13. Points Cover Gasket
14. Points Cover
15. Points Cover Clip
16. Crankshaft Nut

STEP 3 – Locate these parts with the proper names.

9. Coil
10. Flywheel Key
11. Shroud Bolt
12. Coil Clip

Check Point

Get a check sheet from your teacher. Look at the four pictures which follow.

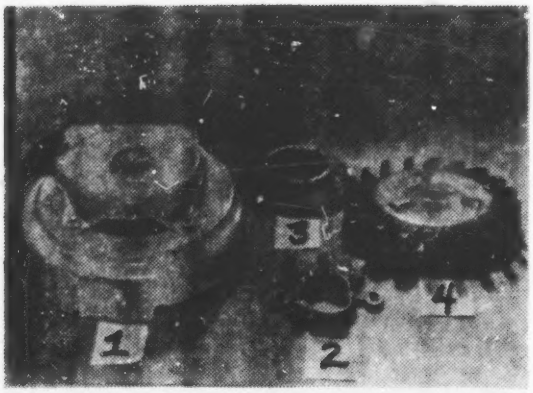
Match the numbers on the picture to the answers you think are correct.

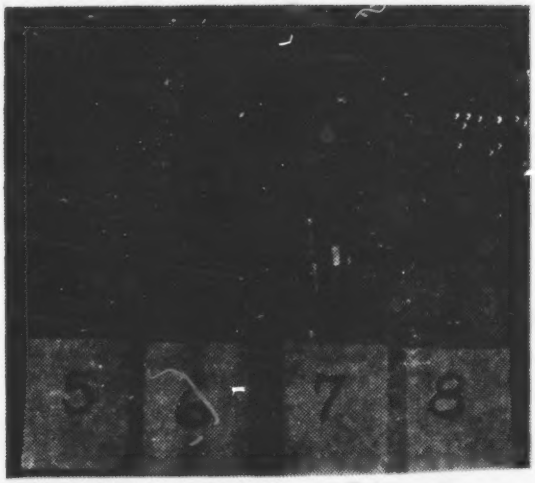
When you have matched all the blanks, check with your teacher to see if you have answered them correctly.

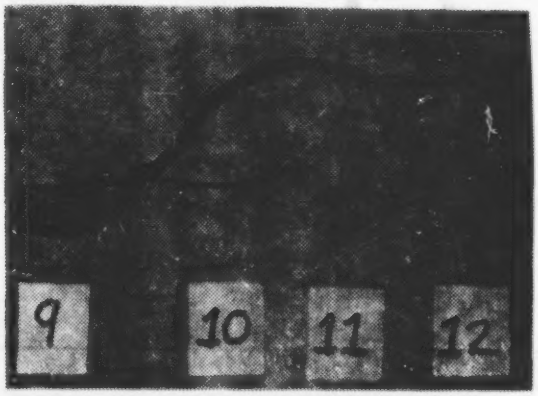
If you have matched them correctly, then get the check sheet for Working on the Ignition System from your teacher and fill in the appropriate blanks at the top of the page.

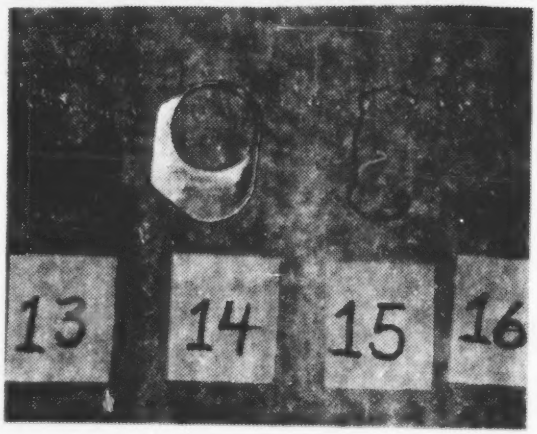
Now you are ready to start work on the engine.

If you missed any, go back to STEPS 1,2,3, and 4, then repeat CHECKPOINT.



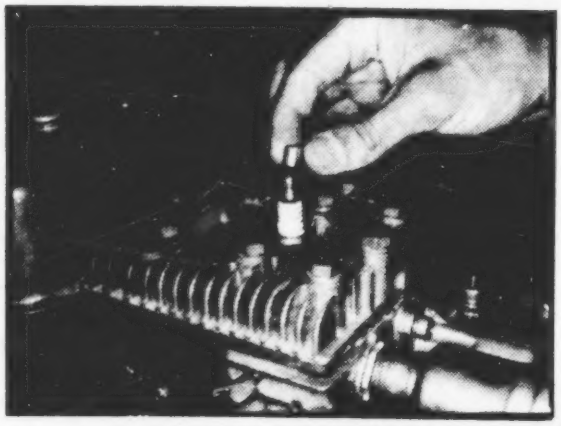




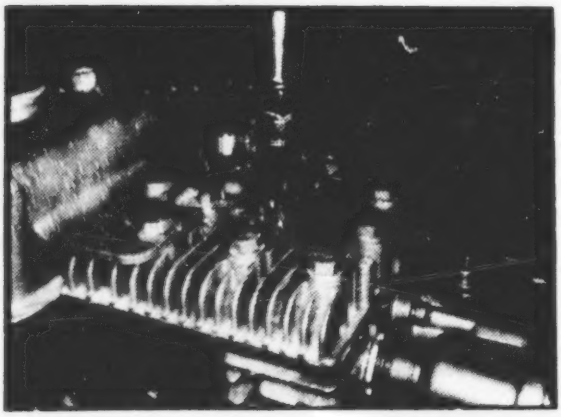


Instructional Objective III

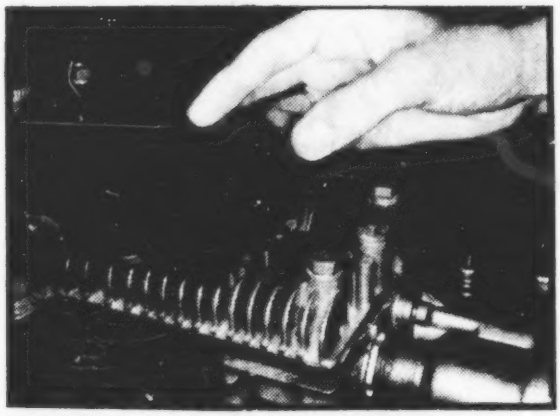
The student will clean a spark plug.



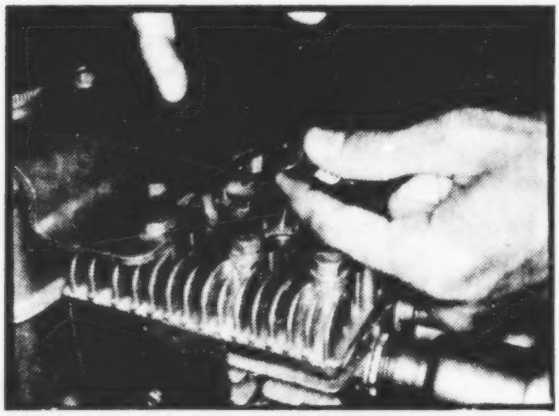
STEP 1 – Remove the spark plug wire.



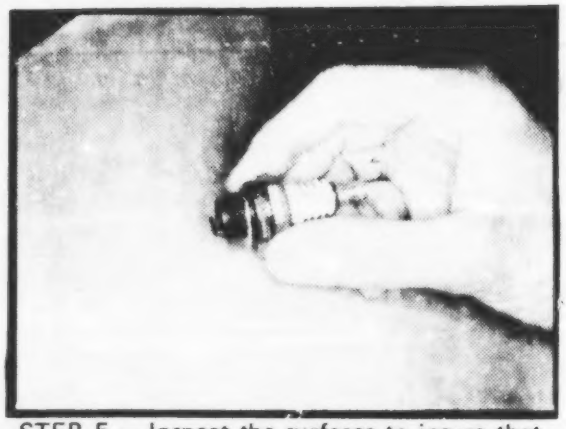
STEP 2 – Using a socket and drive wrench, remove the spark plug by turning it in a counterclockwise direction.



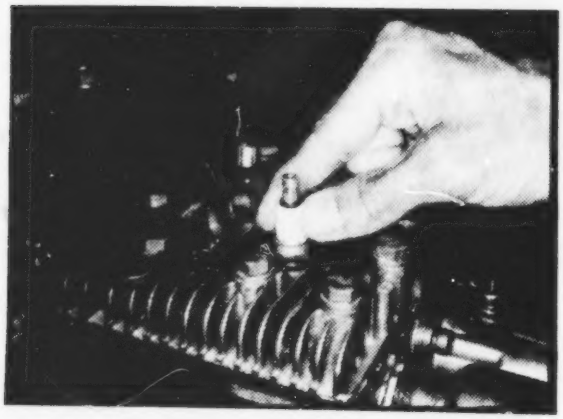
STEP 3 – Obtain a 3 inch (7.6 cm) square piece of emery cloth.



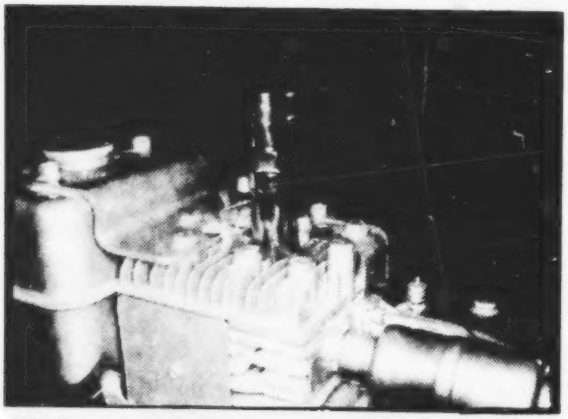
STEP 4 – Gently polish the tips of the electrodes.



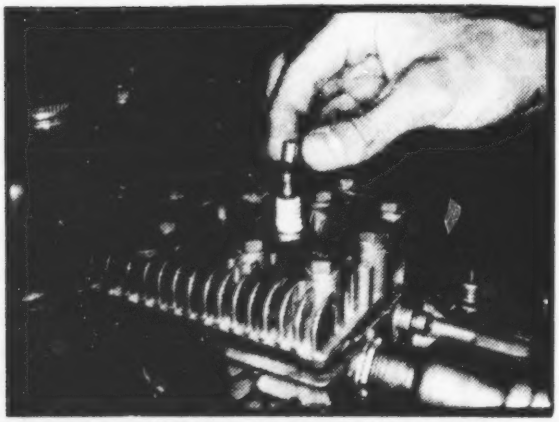
STEP 5 – Inspect the surfaces to insure that no dirt or foreign particles were left on the electrodes.



STEP 6 – Hard tighten the sparks plug in the head.



STEP 7 – Using the torque wrench tighten the plug to 15 foot pounds.



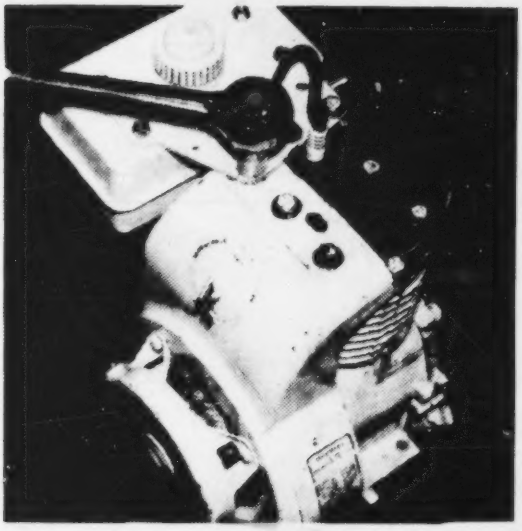
STEP 8 – Replace spark plug wire.

Check Point

Have your instructor initial your cheek sheet.

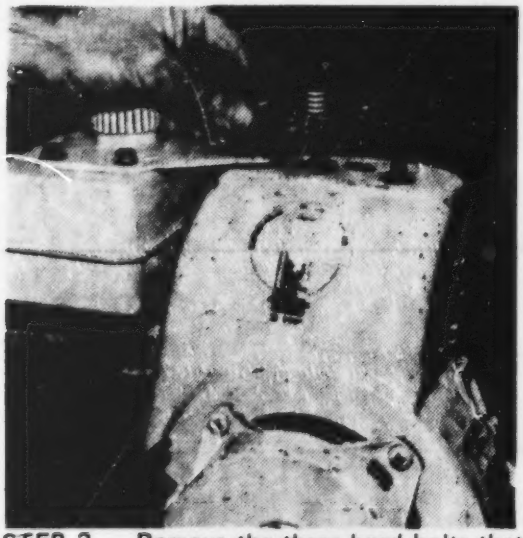
Instructional Objective IV

Using the proper tools, the student will disassemble the ignition system.

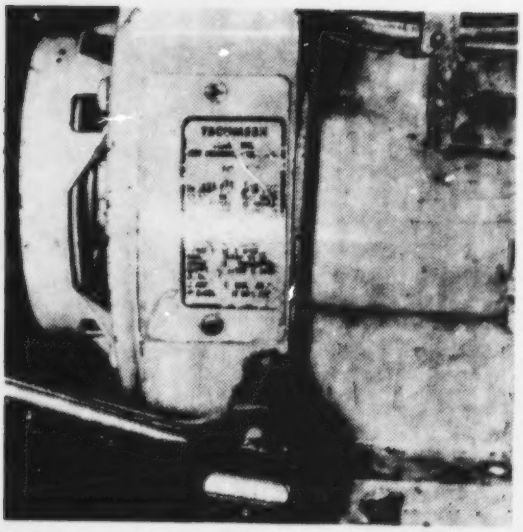


STEP 1 – Now that you are ready to start work on your engine, get out all of your tools and the engine. Remove the spark plug wire.

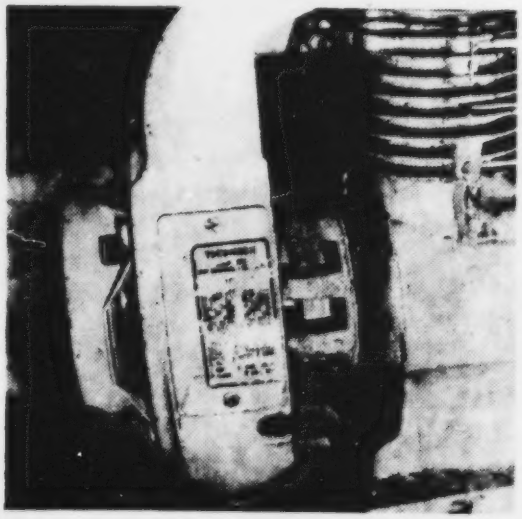
STEP 2 – Using a ½ socket, loosen all of the head bolts.



STEP 3 – Remove the three head bolts that hold the shroud and recoil starter in place.

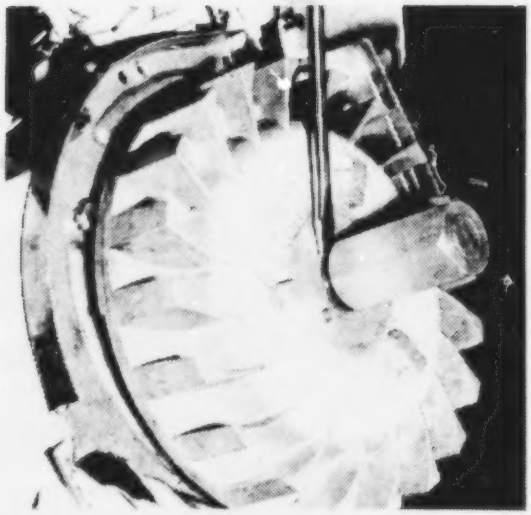


STEP 4 – Now remove the two shroud bolts located at the base of the shroud and recoil starter. You will need to use a 7/16 socket.



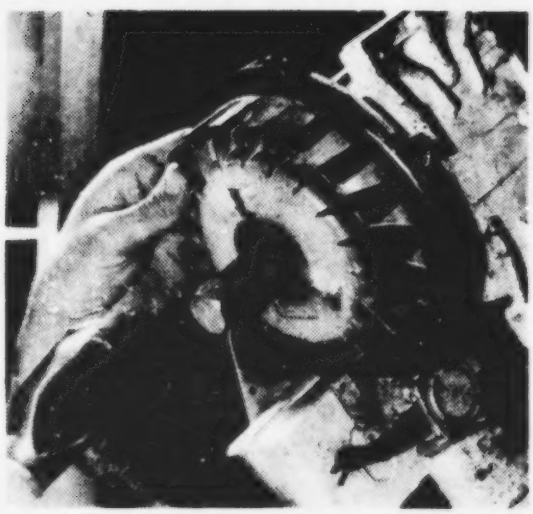
STEP 5 – Remove the shroud and recoil starter.

STEP 6 – Place the flywheel holder on the flywheel to help you hold the flywheel. You will need to use an 11/16 socket to remove the crankshaft nut.

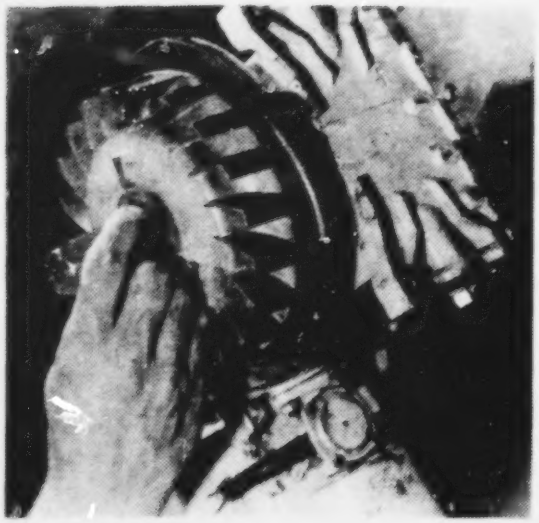


STEP 8 – Screw the knock-off tool to within ¼ inch (.635 cm) of the flywheel.

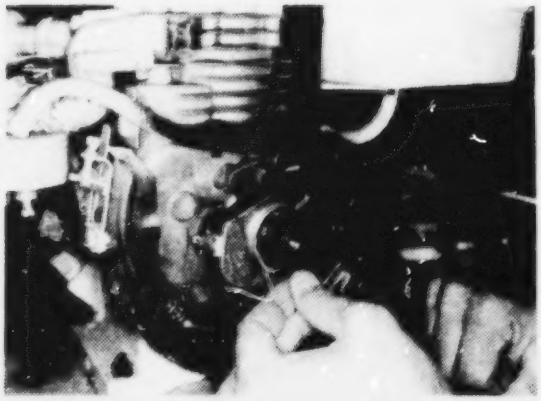
STEP 7 – Remove the screen and recoil starter clutch and crankshaft washer.



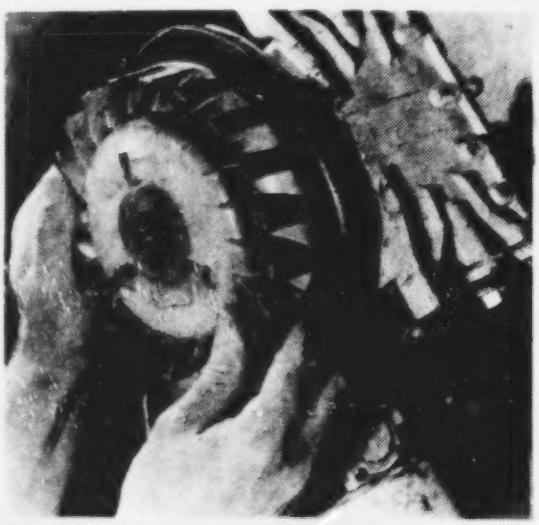
STEP 9 – Hold the engine by the flywheel above the table. Take the brass hammer and hit the knock-off tool sharply several times until the flywheel comes loose.



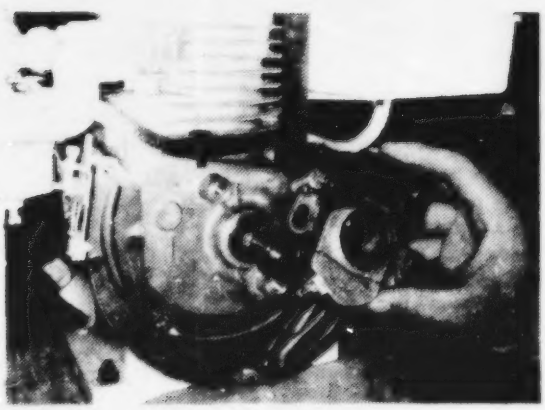
STEP 10 – Unscrew and remove the knock-off tool.



STEP 12 – Remove the flywheel key and check the key and keyway (where the key goes) for damage.

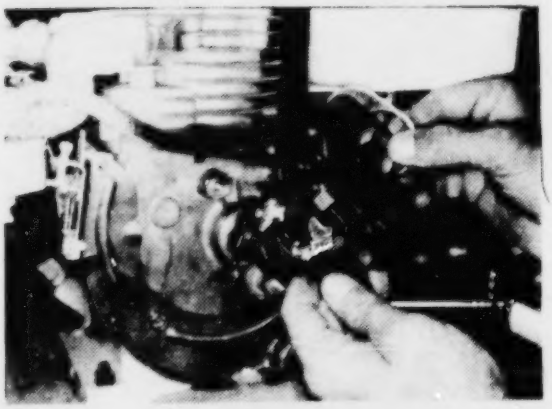


STEP 11 – Remove the flywheel.

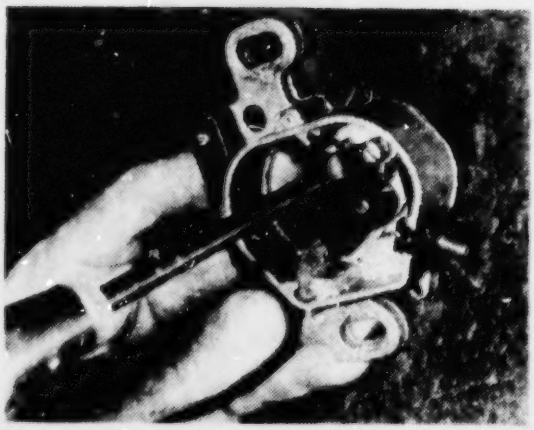


STEP 13 – Use a 7/16 socket to remove the stator assembly bolts.

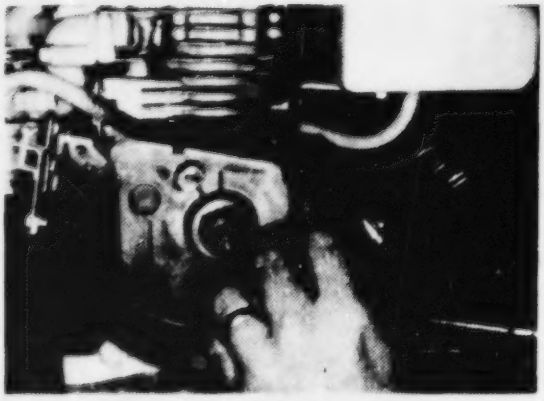
STEP 14 – Take the stator assembly off the engine.



STEP 15 – Remove the points cover clip, points cover, and points cover gasket.



Step 17 – Use the screwdriver to remove the screw that holds the points in place. Now remove the points from the stator assembly.



STEP 16 – Opposite the coil, use the Channel-O-Pliers to remove the nut that holds the wire on the stator assembly. Use a screwdriver to remove the screw that holds the condensor. Now remove the condensor.

Check Point

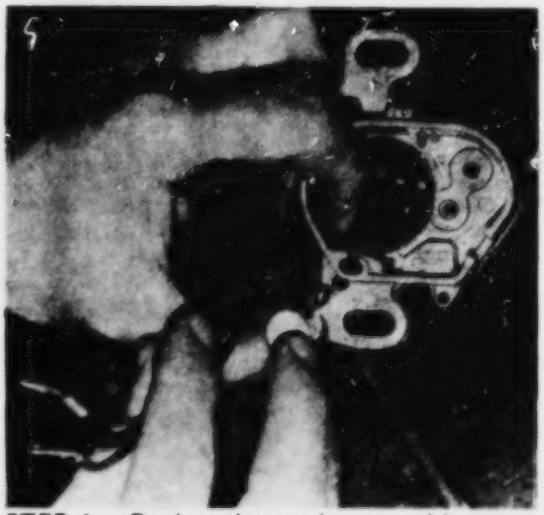
Have your teacher check your work and mark your check sheet.

Now that you have completed taking down the ignition system, see how many parts you are able to identify. If you are not able to identify all the parts, go back to Instructional Objective II, STEPS 1, 2, 3, and 4 to identify the parts you do not know.

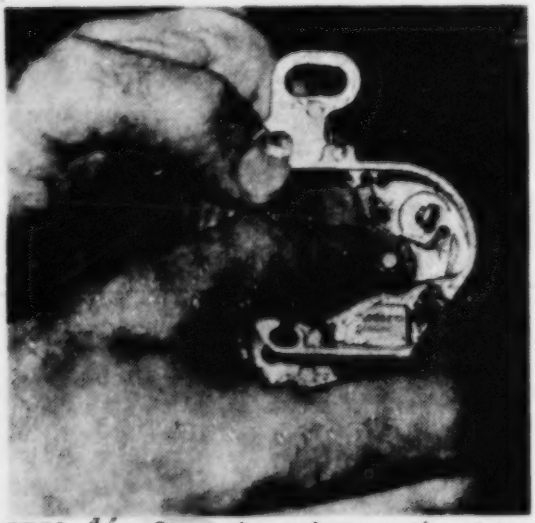
Now that you have taken down the ignition system and have reviewed the parts, you are ready to assemble the ignition system.

Instructional Objective V

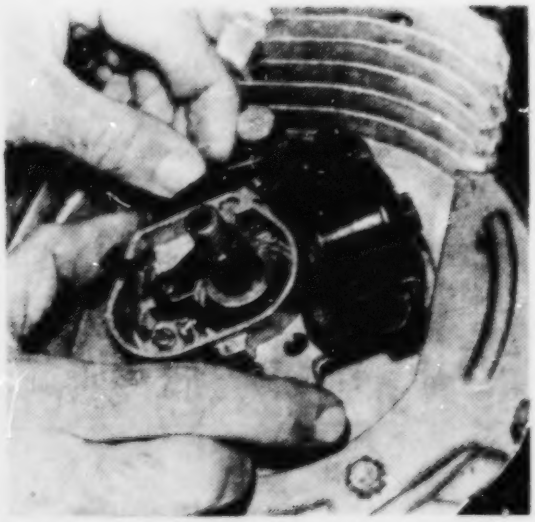
The student will now rebuild the ignition system.



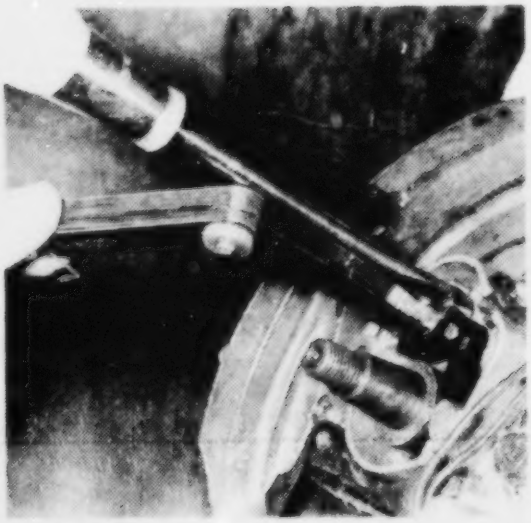
STEP 1 – Replace the condensor making sure the wires come up between the condensor and stator assembly. Use a screwdriver to tighten the screw that holds the condensor on the stator assembly. Make sure that the shortest of the three wires is under that screw.



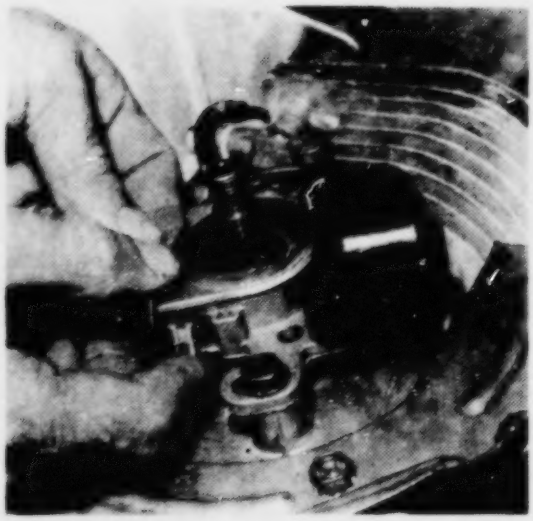
STEP 2 – Place the points on the stator assembly. Make sure that the points are down on the stator assembly before using the screwdriver to tighten the screw that holds the points. Have your teacher check your work and mark your checksheet.



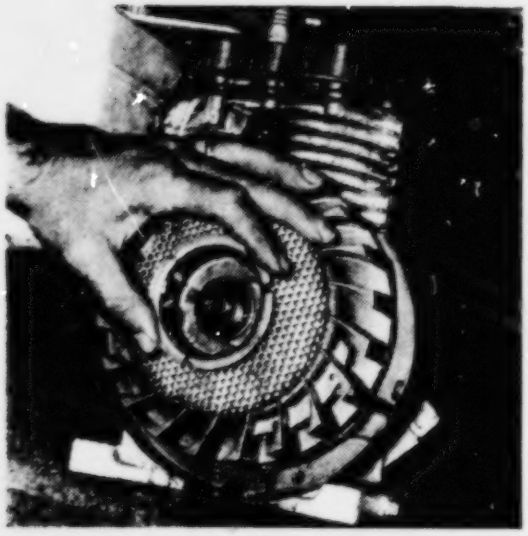
STEP 3 – Put the stator assembly on the engine. Use a 7/16 socket to tighten the stator assembly bolts.



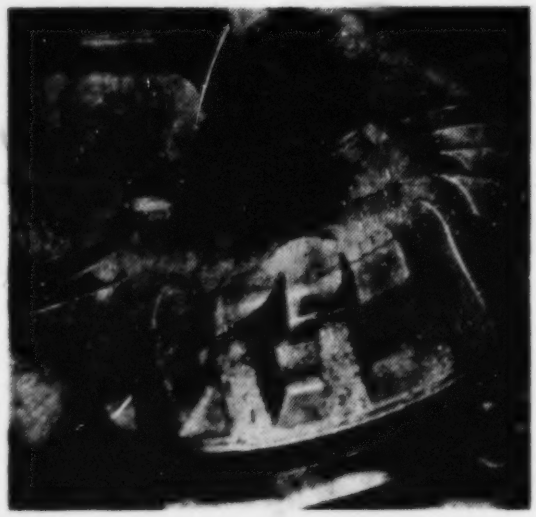
STEP 4 – Use the Channel-O-Pliers to turn the crankshaft so that the cam is to the highest point when in contact with the movable points. Use a screwdriver to loosen the screw that holds the stationary points. Place the feeler gauge between the movable points and stationary points. Move the stationary points so that they come in contact with the feeler gauge. Tighten the screw with the screwdriver so that the stationary points to not move.



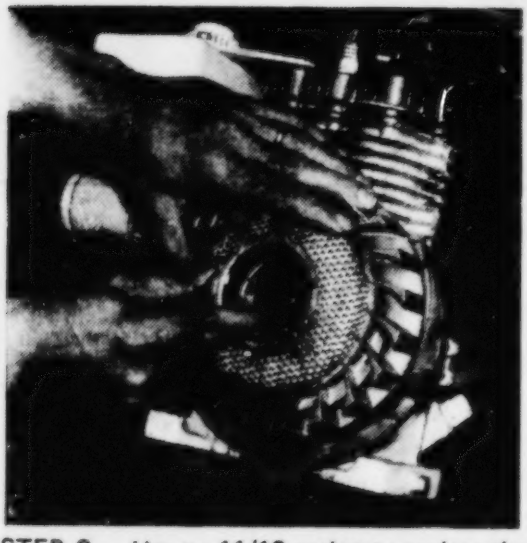
STEP 5 – Replace points cover gasket, points cover, and points cover clip. Have your teacher check your work and mark your check sheet.



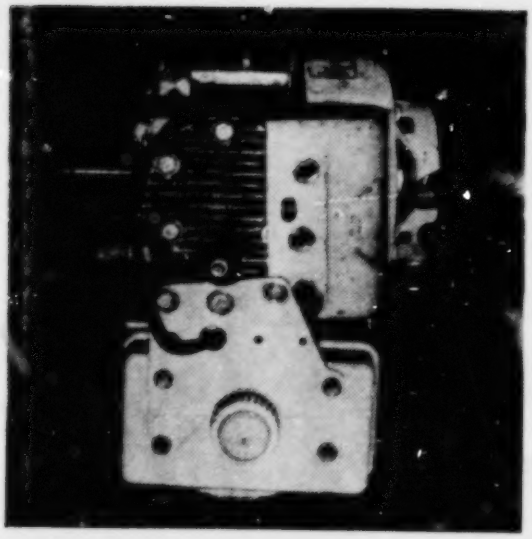
STEP 7 – Replace screen and recoil starter clutch. Make sure that it fits down against the flywheel.



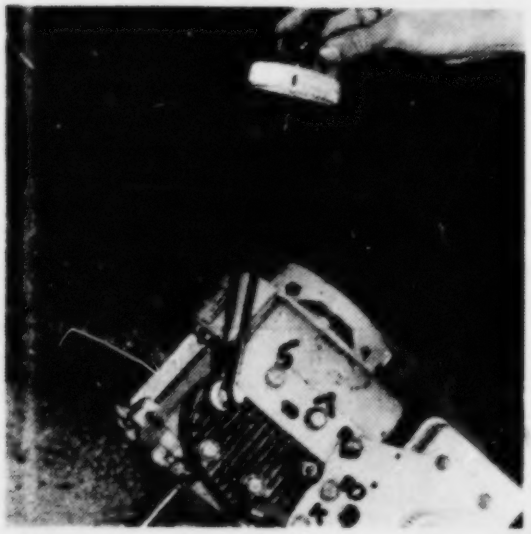
STEP 6 – Replace the flywheel and flywheel key.



STEP 8 – Use an 11/16 socket to replace the crankshaft washer and crankshaft nut. Have your teacher check your work and mark your check sheet.



STEP 9 – Replace shroud and recoil starter.



STEP 10 – Replace the three head bolts. Use the torque wrench and ½ socket to torque the head bolts at 120 in./lbs. Follow the photograph above to torque the head bolts in the correct order. When you have completed this step, have your teacher check your work and mark your check sheet.

STEP 11 – Clamp the engine to a table. Use a 13/16 socket to remove the spark plug. Hold the spark plug wire about 1/8 in. (.3175 cm) from the engine. Pull the rope to see if you are getting fire. A spark will jump across the gap. If you do not get a spark, then you need to repeat all the steps. If you get a spark, replace the spark plug using a 13/16 socket.

STEP 12 – Replace spark plug wire.

STEP 13 – Now you are ready to add gas and oil.

Check Point

Start the engine to check your work.

620.261-010 AUTOMOBILE MECHANIC (auto. ser.) garage mechanic.

Repairs and overhauls automobiles, buses, trucks, and other automotive vehicles: Examines vehicle and discusses with customer or AUTOMOBILE-REPAIR-SERVICE ESTIMATOR (auto. ser.); AUTOMOBILE TESTER (auto. ser.); or BUS INSPECTOR (auto. ser.) nature and extent of damage or malfunction. Plans work procedure, using charts, technical manuals, and experience. Raises vehicle, using hydraulic jack or hoist, to gain access to mechanical units bolted to underside of vehicle. Removes unit, such as engine, transmission, or differential, using wrenches and hoist. Disassembles unit and inspects parts for wear, using micrometers, calipers, and thickness gages. Repairs or replaces parts, such as pistons, rods, gears, valves, and bearings, using mechanic's handtools. Overhauls or replaces carburetors, blowers, generators, distributors, starters, and pumps. Rebuild parts, such as crankshafts and cylinder blocks, using lathes, shapers, drill presses, and welding equipment. Rewires ignition system, lights, and instrument panel. Relines and adjusts brakes, alines front end, repairs or replaces shock absorbers, and solders leaks in radiator. Mends damaged body and fenders by hammering out or filling in dents and welding broken parts. Replaces and adjusts headlights, and installs and repairs accessories, such as radios, heaters, mirrors, and windshield wipers. May be designated according to specialty as AUTOMOBILE MECHANIC, MOTOR (auto. ser.); BUS MECHANIC (auto ser.); DIFFERENTIAL REPAIRER (auto. ser.); ENGINE-REPAIR MECHANIC, BUS (auto. ser.); FOREIGN-CAR MECHANIC (auto. ser.); TRUCK MECHANIC (auto. ser.). When working in service station may be disignated AUTOMOBILE-SERVICE-STATION MECHANIC (auto. ser.). Additional titles: COMPRESSOR MECHANIC, BUS (auto. ser.); DRIVE-SHAFT-AND-STEERING-POST REPAIRER (auto. ser.); ENGINE-HEAD REPAIRER (auto. ser.); MOTOR ASSEMBLER (auto. ser.).

620.684-014 AUTOMOBILE-MECHANIC HELPER (auto. ser.) automobile-mechanic assistant; mechanic helper.

Assists AUTOMOBILE MECHANIC (auto. ser.) in repairing automobiles, buses, trucks, and other automotive vehicles: Raises vehicle to specified level, using hydraulic jack. Removes and disassembles unit, such as engine, transmission, or differential, to be repaired, using handtools and power tools. Cleans unit, using prescribed solvent. Lubricates and washes vehicle. Performs other duties as described under HELPER (any ind.). May be designated according to specialty or worker assisted as TRUCK-MECHANIC HELPER (auto. ser.).

721.281-010 AUTOMOTIVE-GENERATOR-AND-STARTER REPAIRER (auto. ser.)

Tests, repairs, and rebuilds automotive generators and starters: Tests generator unit to ascertain amperage and voltage output, using voltmeter and ammeter. Disassembles unit and cleans brushes, bearings, shafts, and armatures in solvent and examines parts for wear or defects. Reaces commutator using lathe. Tests starter spring tension, using testing device. Replaces or repairs defective parts, and reinstalls generator in vehicle. Adjusts fan belt tension and voltage output. May charge or replace battery. May be designated according to part repaired as AUTOMOTIVE-GENERATOR REPAIRER (auto. ser.) or AUTOMOTIVE-STARTER REPAIRER (auto. ser.).

915.467-010 AUTOMOBILE-SERVICE-STATION ATTENDANT (auto. ser.) filling-station attendant; gas-station attendant; gas tender; service-station attendant.

Services automobiles, buses, trucks, and other automotive vehicles with fuel, lubricants, and accessories: Fills fuel tank of vehicles with gasoline or diesel fuel to level specified by customer. Observes level of oil in crankcase and amount of water in radiator, and adds required amounts of oil and water. Adds necessary amount of water to battery,

and washes windshield of vehicle. Lubricates vehicle and changes motor oil [LUBRICATION SERVICER (auto. ser.)]. Replaces accessories, such as oil filter, air filter, windshield wiper blades, and fan belt. Installs antifreeze and changes spark plugs. Repairs or replaces tires [TIRE REPAIRER (auto. ser.)]. Replaces lights, and washes and waxes vehicle. Collects cash from customer for purchases and makes change or charges purchases, using customer-charge plate. May adjust brakes [BRAKE ADJUSTER (auto. ser.)]. May sell batteries and automobile accessories usually found in service stations. May assist in arranging displays, taking inventories, and making daily reports.